

Citation:

Faith MS, Dennison BA, Edmunds LS, Stratton HH. Fruit juice intake predicts increased adiposity gain in children from low-income families: Weight status-by-environment interaction. *Pediatrics*. 2006 Nov; 118 (5): 2,066-2,075.

PubMed ID: [17079580](#)

Study Design:

Prospective Cohort Study

Class:

B - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To test whether increased fruit juice intake, fruit and vegetable intake, parental restriction of children's eating or baseline weight status were associated with adiposity and whether exposure to nutritional counseling was related to adiposity gain among children participating in the Women, Infants and Children (WIC) program.

Inclusion Criteria:

- Parents with children aged one to four years at baseline if they attended one of 49 WIC agencies in New York surveyed during 1999 through 2000
- Children who had at least three height and weight measures after age two years
- Children who had a height and weight measure at baseline.

Exclusion Criteria:

Records with missing race or ethnicity were excluded.

Description of Study Protocol:**Recruitment**

Surveys were offered to parents attending WIC clinics who had a child aged one to five years.

Design

- Self-administered questionnaires were given to parents attending WIC clinics between July and December 1999 and May and December 2000
- Each child's most recent height or length, weight and date of measurement were abstracted

from his or her WIC chart at the time of the survey; frequently the measurements were taken on the same day as the survey was completed

- Additional data were obtained for each study child beginning in December 2001 through September 2002 by abstracting height, weight and measurement data from WIC charts
- These additional data were compared to survey and anthropometric data collected at baseline.

Dietary Intake/Dietary Assessment Methodology

- Self-administered questionnaires in English or Spanish were filled out by a parent, and included questions on the usual number of servings per day of milk, fruit juice, fruit and vegetables (excluding carrots, potatoes or salad) that the child consumed
- The fruit and vegetable questions were adapted from the Behavioral Risk Factor Surveillance system questionnaire
- A single-serving was defined as 3/4 cup of milk or juice and 1/2 cup of fruit, vegetable, potatoes or carrots
- The questionnaire also included questions on the type of milk usually consumed by the child, and contained questions related to parents' feeding style and exposure to WIC nutrition counseling services.

Statistical Analysis

- Chi-square statistics, T-tests or ANOVA were used to assess differences in characteristics between participants included in the study sample and those excluded and were used to test differences in study variables by the child's race or ethnicity, gender and baseline overweight status
- Change in adiposity was defined as change in age- and gender-standardized body mass index (BMI) per month and was estimated individually by linear regression for each child
- Multiple regression models tested the prospective association between children's food and beverage intake, as well as parental feeding styles and attitudes variables, with change in children's adiposity
- The primary regression models included as predictors all child food- and beverage-intake variables, all parenting behavior variables and initial child weight-for-height z-score. Next, an interaction model tested whether any significant predictor from the primary regression model interacted with child baseline overweight status. Any significant interactions were followed up with stratified regression analyses testing children who were at risk or overweight at baseline compared to those who were not
- Additional regression models added three questions concerning parental exposure to WIC nutrition counseling to perform preliminary analyses on the effects of counseling on child dietary intake and weight status
- Statistical significance was set at $P < 0.05$.

Data Collection Summary:

Timing of Measurements

- Self-administered questionnaires were given to parents attending WIC clinics between July and December 1999 and May and December 2000
- Each child's most recent height or length, weight and date of measurement were abstracted from his or her WIC chart at the time of the survey; frequently the measurements were taken on the same day as the survey was completed

- Additional data were obtained for each study child beginning in December 2001 through September 2002 by abstracting height, weight and measurement data from WIC charts. These additional data were compared to survey and anthropometric data collected at baseline.

Dependent Variables

- Adiposity gain was determined by measuring height and weight, and computing age- and gender-specific BMI percentiles and z-scores from the 2000 Centers for Disease Control and Prevention growth charts
- Change in adiposity was defined as the change in age- and gender-standardized BMI per month, and this score was estimated individually by linear regression for each child.

Independent Variables

- Consumption of fruit juice, milk, fruits and vegetables was measured by self-administered parent surveys
- Parental feeding style was measured by self-administered parental surveys
- Parent exposure to WIC nutrition counseling services was included in the year 2000 survey only.

Description of Actual Data Sample:

- *Initial N*: 1,800
- *Attrition (final N)*:
 - The survey sample had N=1,797 subjects (N=33 were excluded for missing race or ethnicity data)
 - The study sample had N=971 (N=826 were excluded because they did not have at least three measures after age two years and did not have baseline height and weight measure), with 53.2% being male
- *Mean age*: 30.2±9.0 months at baseline was
- *Ethnicity*:
 - 35.8% were Non-Hispanic white
 - 20.5% were Non-Hispanic black
 - 34.5% were Hispanic
 - 9.2% were "other"
- *Other Relevant Demographics*:
 - Parent age at survey: 29.6±10.0 years
 - Residence location identified as "Downstate": 63.7%
 - Education level:
 - 31.2% had less than high school
 - 40.0% had a high school education
 - 28.8% had more than high school
- *Anthropometrics*:
 - Weight at baseline (kg): 14.2±2.9
 - Height at baseline (cm): 91.1±7.4
 - Weight z-score at baseline: 0.45±1.3
 - Height z-score at baseline: 0.26±1.0
 - Overweight at baseline: 17.3%
 - At risk of overweight at baseline: 15.6%
 - Baseline weight and height z-score: 0.4±1.3
- *Location*: Subjects attended one of 49 New York State WIC clinics

- 22 of the WIC clinics were located in New York City ("Downstate")
- 27 were located in Upstate New York.

Summary of Results:

- In the interaction regression model, there was a significant overweight status by fruit juice interaction ($P=0.01$), such that for children who were at risk or overweight at baseline, each additional daily serving of fruit juice intake was associated with an additional BMI z-score gain of 0.009 SD per month ($P<0.01$), and boys showed a greater adiposity gain than girls ($P=0.04$)
- Greater parental offering of fruit was associated with reduced adiposity gain ($P=0.06$)
- Children who were at risk or overweight were less likely to consume 2% or whole milk ($P=0.01$) compared to children who were normal weight
- Children who were at risk or overweight were more likely to have parents report limiting their food intake ($P<0.001$) compared to children who were normal weight.

Other Findings

- Boys consumed significantly more milk (3.3 ± 1.1 servings per day) compared to girls (3.2 ± 1.1 servings per day) and were more likely to consume 1% or skim milk (89.2%) than 2% or whole milk compared to girls (93.8%) ($P<0.01$)
- Parents were significantly more likely to restrict girls' food intake than boys' food intake ($P<0.03$)
- Hispanic children consumed significantly more carrots than non-Hispanic white or black children ($P<0.002$)
- Hispanic children consumed significantly more fruit juice than non-Hispanic white children ($P<0.01$)
- Hispanic children and non-Hispanic black children consume significantly more fruit than non-Hispanic white children ($P<0.01$)
- Hispanic children consume significantly more milk than non-Hispanic white and black children, and others ($P<0.02$)
- Non-Hispanic white and Hispanic children were less likely to drink 2% milk than were non-Hispanic black children and others ($P<0.01$)
- Parents of white children reported that WIC staff discussed serving low-fat milk more frequently ($P=0.04$) and discussed serving more vegetables less frequently ($P=0.01$) than did parents of non-white children
- Parents of non-Hispanic white children reported being less restrictive and were less inclined to agree that children should be encouraged to finish eating dinner before dessert ($P<0.05$) compared to other groups
- Parental exposure to WIC nutrition counseling was not associated with change in children's adiposity (NS).

Author Conclusion:

- Among children who already are at high risk to become obese adults, increased juice intake was associated with increased adiposity gain. Each additional daily serving of juice was associated with an excess BMI z-score of 0.009 SD per month
- Parental offerings of whole fruits are associated with reduced adiposity gain
- There was a cross-sectional association between low-fat milk intake and child overweight

status, but no longitudinal association

- Parents of at-risk or overweight children reported greater feeding restriction than parents of healthy-weight children
- Mothers of white children reported less feeding restriction than did mothers of other races or ethnicity
- Parental WIC nutrition counseling was not associated with change in children's adiposity.

Reviewer Comments:

- *This study may also be relevant for the NEL question related to dairy and childhood overweight and obesity*
- *This study did not distinguish between fruit juice and 100% fruit juice*
- *Reliability and validity of the survey instrument used in this study was not reported.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

- | | | |
|----|---|-----|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | N/A |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? | Yes |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? | Yes |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies) | N/A |

Validity Questions

- | | | |
|------|---|-----|
| 1. | Was the research question clearly stated? | Yes |
| 1.1. | Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified? | Yes |
| 1.2. | Was (were) the outcome(s) [dependent variable(s)] clearly indicated? | Yes |
| 1.3. | Were the target population and setting specified? | Yes |
| 2. | Was the selection of study subjects/patients free from bias? | Yes |
| 2.1. | Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? | Yes |
| 2.2. | Were criteria applied equally to all study groups? | Yes |

2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	Were study groups comparable?	No
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	No
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	No
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	Was method of handling withdrawals described?	No
4.1.	Were follow-up methods described and the same for all groups?	No
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	No
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	No
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	Was blinding used to prevent introduction of bias?	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes

5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	No
6.6.	Were extra or unplanned treatments described?	No
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	Were outcomes clearly defined and the measurements valid and reliable?	No
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	No
7.5.	Was the measurement of effect at an appropriate level of precision?	No
7.6.	Were other factors accounted for (measured) that could affect outcomes?	No
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes

8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	No
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	No
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	Are conclusions supported by results with biases and limitations taken into consideration?	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	Is bias due to study's funding or sponsorship unlikely?	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes